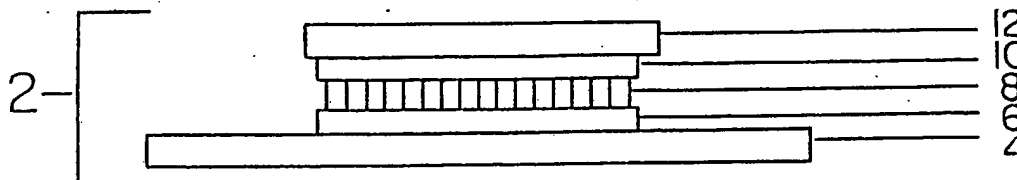




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(54) Title: PLUSH TEXTURED MULTICOLORED FLOCK TRANSFER AND METHOD FOR MAKING SAME USING PRECOLORED FLOCK

**(57) Abstract**

A method of making a multicolored flock transfer which involves printing a release adhesive in a predetermined design upon a base sheet; sequentially flocking different colored flock through an open section of a barrier into the adhesive to result in a plurality of predetermined single color patterns arranged to form the predetermined design; and applying a binding adhesive to free ends of the flock. The multicolor flock transfer includes a base sheet (4) having a surface area coated with a release adhesive (6); precolored flock (8) of at least two different colors having ends adhering to the surface area of the base sheet to form predetermined color patterns of a design; and a binding adhesive (10) applied to other ends of the precolored flock, and preferably also includes a layer of supplemental adhesive (12) covering the binding adhesive.

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PLUSH TEXTURED MULTICOLORED FLOCK TRANSFER AND METHOD
FOR MAKING SAME USING PRECOLORED FLOCK

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The invention generally relates to a method of manufacturing flock transfers. Specifically, the invention is directed to methods of manufacturing flock transfers which exhibit an enhanced texture, particularly flock transfers composed of a plurality of precolored flock.

10 2. Description of the Prior Art

There are two basic methods of applying a multicolor flock design to a surface. The first method is referred to as direct flocking. The second is by means of flock transfers.

15 In the former instance, the flock is applied directly to the surface that forms the finished product. Usually wallpaper, carpets and decorative elements of garments are produced in this manner.

An example of direct flocking is found in U.S. Patent
20 No. 3,793,050 to Mumpower. This particular direct flocking method is unique in that it allows the use of different color and size of flock in the same design surface to be flocked. The adhesive is rendered tacky and each color of flock is passed through a screen that restricts that color
25 to the desired part of the adhesive layer. A multicolor flock design is thus obtained on the surface.

Multicolor direct flocking suffers a number of disadvantages. It is an exacting procedure with many variables to be controlled requiring specialized flocking
30 equipment and an environment that is controlled for relative humidity. During the startup of such a procedure many reject-quality articles may result as the variables are adjusted by trial and error until the desired result is found. The procedure is relatively slow since usually only
35 one article at a time may be decorated. Further, if the article to be decorated has an uneven surface like many

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textiles, then density of the flock, control, speed and the quality of the finished design i.e. sharpness of lines separating colors, vivid images, etc., would be adversely affected.

5 It is believed that direct flocking has been limited in use in the United States.

 Examples of flock transfers, i.e., the second method of employing flock fibers in a decorative manner, are illustrated in United States Patents 4,292,100 and 4,396,662
10 both to Higashiguchi and UK Patent applications 2,065,031 to Maitland and 2,126,951 to Transworth. Transfers are formed by applying flock to a release sheet having a temporary release adhesive coating. The flock is then colored with different color inks and coated with a binding layer and hot
15 melt adhesive in a desired decorative design. The transfers are applied to articles with heat and pressure. The release sheet is peeled away leaving a finished decorative design.

 Conventional multicolor flock transfers also suffer from a number of disadvantages. The basic underlying
20 problem is that the flock transfers use a very short fiber and are, therefore, relatively flat so that a plush textured multicolored look is not achieved. Thus, a transfer having a richly textured appearance has not been achieved using flock to justify the additional cost over conventional
25 screen printing.

 In this regard, flock fibers of conventional flock transfers must be short because of a fundamental limitation of conventional flock transfer manufacturing methods caused by the problem of penetrating the flock fiber with printing
30 ink to form the desired design. Typical flock fibers used in flock transfers are only about 0.3 mm long because if fibers longer than about 0.3 mm are used, it is difficult for subsequently applied ink to penetrate along the full length of the fibers; when a sufficient amount of ink is
35 supplied to do so there results a smudged design. This is unlike direct flocking which can use precolored flocks of

approximat ly 0.5 mm to 3³ mm in length.

An object of the present invention, therefore, is to produce a plush textured multicolored flock transfer which has a three dimensional appearance using longer flock than heretofore was possible.

Another object is to provide a method of producing plush-textured, multicolored flock transfers in batches containing more than one transfer per batch.

Another further object of the invention is to provide a method of decorating articles with a multicolor plush textured design which overcomes the disadvantages and limitations of direct flocking.

Another still further object of the invention is to allow manufacturers of products to economically make use of plushly-textured flock designs in place of screen printed designs.

SUMMARY OF THE INVENTION

In general, the present invention is directed to a multicolored flock transfer comprising flock having a fiber length longer than about 3 mm, up to about 5 mm, and preferably longer than about 5 mm, up to about 1 cm, and longer than 1 cm for the most preferred plush texture.

Related to this, the present invention is also directed to a fabric including a substrate material; a layer of binding adhesive having a predetermined design applied to the substrate; and precolored flock of at least two different colors adhering to the layer.

In accordance with the present invention there is also provided a method of applying a multicolor flock transfer to a substrate material which involves providing a multicolor flock transfer including flock having a fiber length longer than about 3 mm up to about 5 mm, and preferably longer than 5 mm up to 1 cm, and more preferably longer than 1 cm, and applying the multicolor flock transfer using heat and pressure to a substrate material, such as a fabric or textile, which may have a textured or irregular surface.

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In order to accomplish the previously mentioned objects, the present invention is directed to a method of making a multicolored flock transfer or transfer sheets which involves sequentially flocking a different precolored flock into a pre-designated color pattern of an overall design using flock having relatively long fibers to result in a plush textured flock transfer.

More particularly, the present invention is directed to a process for manufacturing transfer sheets which involves forming on the surface of a base sheet an adhesive layer for temporary adhesion of a plurality of different colored flock fibers to the base sheet, temporarily sticking the different colored flock to the adhesive layer to form a multicolored fiber layer, and applying an adhesive in the multicolor fiber layer to a desired pattern to form a binding adhesive layer, wherein the colored flock fibers are precolored to the plurality of different colors before sticking the different colored flock fibers to the adhesive layer.

The present invention, more specifically, is directed to a method of making a multicolored flock transfer which involves printing a release adhesive upon a base sheet; sequentially flocking different colored flock fibers through an open section of a barrier into the adhesive to result in a plurality of predetermined single color patterns arranged to form a predetermined design; and applying a binding adhesive to free ends of the flock fibers.

The present invention is also directed to a multicolor flock transfer which includes a base sheet having a surface area coated with a release adhesive; precolored flock fibers of at least two different colors having ends adhering to said surface area to form predetermined color patterns of a design; and a binding adhesive applied to other ends of said precolored flock fibers, wherein the multicolor flock transfer of the present invention preferably also includes a layer of supplemental adhesive covering the binding adhesive.

For purposes of the present invention, the colored flock include fibers longer than .3 mm, e.g., having a length within the range of 0.5-3 mm, but preferably having a length of at least about 3 mm up to about 5 mm, although
5 fibers having a length greater than 5 mm up to about 1 cm are more preferred, and flock with fibers particularly longer than 1 cm are most preferred for producing flock transfers with a plush texture.

The flock fibers should be conductive material, such as
10 synthetic materials, selected from the group consisting of rayon, nylon, polyamide and polyester materials, and preferably is rayon.

The base sheet is a material selected from the group consisting of paper, resin and metal foil and preferably is
15 a dimensionally stable sheet of paper, which may be transparent.

The release adhesive may be applied in the form of a solution or emulsion, such as a resin or a copolymer, such as polyvinyl acetate, polyvinyl alcohol, polyvinyl chloride,
20 polyvinyl butyral, acrylic resin, polyurethane, polyester, polyamides, cellulose derivatives, rubber derivatives, starch, casein, dextrin, gum arabic, carboxymethyl cellulose, rosin, or compositions containing two or more of these ingredients.

25 The binder adhesive is a resin, preferably selected from the group consisting of polyvinyl chloride, polyvinyl acetate, polyurethane, polyester polyamide, and acrylic resin, such as a water based acrylic resin, and may also include a hot melt adhesive, such as a hot melt adhesive
30 selected from the group consisting of polyurethane, polyester and nylon, which is preferably applied as a separate adhesive layer.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is cross-section of the multicolor transfers in
35 accordance with the present invention.

Fig. 2 is a cross-section of the multicolor transfer in

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accordance with the present invention illustrated in Fig. 1 showing its application to a textile or fabric.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in Fig. 1, the transfer 2 of the flock transfer present invention comprises a base sheet 4, such as dimensionally stable paper, to which a conventional flock transfer release adhesive 6, usually silicone wax, is applied. The base sheet, however, may be any material which can be suitably used with the adhesive which should be selected to effect temporary adhesion of the flock fibers. Although paper, such as processed paper, is preferred, resin sheets and metal foils may also be employed. Depending on the desired effect and the sheet materials employed, the base sheet may be transparent, translucent or opaque.

The release adhesive 6 may be applied in the reverse of a desired pattern, that is, a pattern which corresponds to the overall image which is to be flocked. Preferably, however, the release adhesive may be applied without regard to the overall design desired, particularly when the precolored flocks are sequentially applied to the adhesives, as discussed in more detail hereinbelow. The release adhesive may be applied in the form of a solution or emulsion, such as a resin or a copolymer, such as polyvinyl acetate, polyvinyl alcohol, polyvinyl chloride, polyvinyl butyral, acrylic resin, polyurethane, polyester, polyamides, cellulose derivatives, rubber derivatives, starch, casein, dextrin, gum arabic, carboxymethyl cellulose, rosin, or compositions containing two or more of these ingredients.

The flock 8 is preferably composed of fibers, which may be referred to herein as flock fibers. The flock may be rayon, and other types of conductive material, such as nylon, polyamide, polyester and similar synthetic fibers, and is applied to the activated adhesive 6 by conventional electrostatic processes, spraying, or by gravity, such as sprinkling or vibrating the flock onto the surface of the base sheet provided with the release adhesive.

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The flock 8 is coated with a binder adhesive 10, such as a water based acrylic, which binds the flock into a unit. Preferably the binding adhesive is applied in the form of a solution or emulsion. The binder adhesive preferably contains a resin, such as polyvinyl chloride, polyvinyl acetate, polyurethane, polyester, polyamide, and acrylic resin, and preferably the previously mentioned water based acrylic. The binder adhesive 10 may contain additional or supplemental adhesives, such as a hot melt adhesive, usually a granular polyester or nylon, for binding the transfer to a substrate. Alternatively, the hot melt adhesive 12, may form a separate layer. The use of separate hot melt layers is preferable. In addition, other heat sensitive adhesives, such as polyvinyl chloride, thermoplastic acrylic resin, polyethylene, polyamide, polyurethane, paraffin and rubber derivative may be used for this purpose, with polyurethane being preferred.

In order to achieve a multicolor effect, the flock 8 is applied through a barrier which is preferably a gauze-like mesh screen. The multicolor effect is achieved by using different precolored flock. As used herein, precolored flock means that the flock has been colored before being flocked, stuck or otherwise applied to the release adhesive. Depending on the overall design and the number of colors of flock which are to be used, an appropriate number of barriers or screens are prepared to have open sections to permit passage of flock in a predetermined configuration or color pattern. Alternatively, a single screen may be sequentially masked for this purpose. In either case, the open sections of each mask or screen are designed to permit passage of flock fibers in a configuration which corresponds to the areas of the final design which correspond to only one of the plurality of colors, i.e. color pattern, intended to be used in the final or overall design. In accordance with the present invention, each different color of flock is preferably applied sequentially using a

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different screen to result in the particular precolored flock passing through the open section of the screen onto a corresponding section of the release adhesive 6 to form a color pattern.

- 5 Inasmuch as the precolored flock which form the color pattern do not require being printed with ink following flocking in order to effect different colors, as in a conventional multicolor transfer, the length of the flock can be as long as practical for the transfer depending on
- 10 the desired aesthetic effect. In this regard, the flock fibers may be substantially longer than 0.3 mm, or even longer than 0.5-3 mm, the main limiting concern being the plushness of the texture of the flock transfer and the desired aesthetic effect which is intended to be achieved.
- 15 In this regard, flock transfers having a fiber length of within the range of 3 mm up to 5 mm, and longer, can be used to result in a flock transfer which is much more plush, vivid and three dimensional than flock transfers wherein shorter fibers, i.e. 0.3 mm or 0.5-3 mm, are used. In
- 20 accordance with the present invention, therefore, flock having a fiber length within the range of 5 mm to 1 cm is more preferred with a fiber length longer than 1 cm being most preferred.

- Fig. 2 illustrates the application of the transfer to a
- 25 textile 14, such as garment, or other surface. In accordance with the present invention, the substrate material, i.e., fabric or textile, can have a relatively smooth, regular surface, such as a piece of cloth, or may have a textured or irregular surface, such as fishnet
- 30 material. In this regard, the present invention is applicable to any type of garment or piece of wearing apparel to which it is desired to affix or imprint a word, design, logo, emblem or other sign or symbol, particularly shirts, jerseys, jackets, pants, shorts and caps, such as
- 35 those designed to be worn during athletic activities, e.g., U.S. football jerseys and baseball caps. Moreover, although

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flock transfers are normally applied to substantially flat surfaces of a garment, the flock transfers of the present invention are particularly suitable for application of a flocked design to a curved or undulating surface without
5 adversely affecting the vividness or other characteristics of the flocked design. Thus, the flock transfer of the present invention is advantageous in that it can be applied to almost any type of surface regardless of its texture or configuration. For example, although many textiles or
10 fabrics to which flock designs are transferred may have a close-knit weave, the flock transfers of the present invention may be applied to fishnet and open mesh fabrics as well. To this end, the hot melt surface 12 is placed against the textile 14. Heat and pressure is applied to the
15 release sheet 4 in order to bond the transfer to the garment. The release sheet 4 with the adhesive 6 is then pulled away from the flock 8. This leaves a transfer permanently affixed to the garment.

The present invention utilizes the general materials
20 and flocking techniques found in the United States Patents 3,793,050; 4,292,100; and 4,396,662 and UK Patent applications 2,605,031 and 2,126,951, all of which are incorporated by reference herein.

Although the invention utilizes conventional materials
25 and techniques which can be generally found in various prior art references, the specific manner by which the method of the present invention is performed permits a much longer flock than heretofore was practical to be used so that the particular combination of elements and the manner by which
30 they are combined in accordance with the present invention produces a unique and superior flock transfer.

EXAMPLE

The following is an illustrative example of a method of
35 producing the flock transfers for purposes of the invention comprises:

10

a) an acrylic layer 6 is applied in the revers of a predetermined pattern to a dimensionally stable base sheet 4, such as a bond paper;

b) a first color of nylon flock fibers 8 having a length of about 5mm is passed through a monofilament polyester screen for ten to fifteen seconds in an electrostatic field. The screen has open sections in those areas which correspond to the first colored section of the reversed design. Inasmuch as the wax acts as a ground for the charged particles, the flock 8 becomes embedded in the wax layer 6;

c) this procedure is then followed for each succeeding color of nylon flock fibers 8 that is to be electrostatically flocked in order to form the desired design, after which the resultant unit is dried;

d) the tips of the exposed flock 8 are printed using conventional screen printing equipment with a water based (40%-60% water) acrylic binder 10. The binder 10 binds the flock 8 and further provides opacity and brilliance by reflecting light;

e) the binder 10 is dusted or powered with a polyurethane hot melt adhesive 12 and the transfer is then air-dried;

f) after brushing and vacuuming excess adhesive 12, the transfer is placed in an infrared dryer to cross link the binder 10 and adhesive 12 to form the multicolor flock transfer in accordance with the present invention.

To apply the transfer to a textile 14, the adhesive surface 12 is positioned on the textile 12. A hot surface heated to a temperature of about 300-350° F is pressed against the paper for about 20-30 seconds. The transfer is allowed to cool, preferably to an extent that it can be manipulated by hand, and the paper 4 and wax 6 are removed by peeling the paper 4 from the flock 8. The desired flock design is thus transferred and permanently affixed to the textile.

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It is believed that the advantages and improved results furnished by the methods and products of the present invention are apparent from the foregoing description of the preferred embodiment of the invention. Various changes and
5 modifications may be made without departing from the spirit and scope of the invention as described in the claims that follow.

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IN THE CLAIMS:

1. A method of making a multicolored flock transfer comprising:

5 a) printing a release adhesive upon a base sheet;

b) sequentially flocking different colored flock through an open section of a barrier into said adhesive to result in a plurality of predetermined single color patterns arranged to form a predetermined design; and

10 c) applying a binding adhesive to free ends of said flock.

2. The method of claim 1, wherein said base sheet is a material selected from the group consisting of paper, resin and metal foil.

15 3. The method of claim 2, wherein said base sheet is paper.

4. The method of claim 2, wherein said base sheet is transparent.

20 5. The method of claim 1 wherein said, colored flock comprise fiber having a length within the range of 3 mm to 5 mm.

6. The method of claim 1, wherein said colored flock comprises fibers having a length within the range of 5 mm to 1 cm.

25 7. The method of claim 1, wherein said colored flock comprises fibers have a length of at least about 1 cm.

8. The method of claim 1, wherein said different colored flock comprises fibers having a length longer than .3 mm.

30 9. The method of claim 1, wherein said barrier is a mesh screen.

10. The method of claim 1, wherein said binder adhesive is a resin.

35 11. The method of claim 10, wherein said resin is selected from the group consisting of polyvinyl chloride, polyvinyl acetate, polyurethane, polyester polyamide, and

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acrylic resin.

12. The method of claim 1, wherein said binder adhesive is an acrylic resin.

13. the method of claim 1 wherein wherein said binding
5 adhesive comprises a hot melt adhesive.

14. The method of claim 13, wherein said hot melt adhesive is selected from the group consisting of polyurethane, polyester and nylon.

15. The method of claim 14 further comprising applying
10 a hot melt adhesive as a separate adhesive layer.

16. The method of claim 1, wherein said flock comprise conductive material.

17. The method of claim 16, wherein said conductive material is a synthetic material.

15 18. The method of claim 17, wherein said flock fibers comprise a material selected from the group consisting of acrylic rayon, nylon, polyamide and polyester materials.

19. The method of claim 18, wherein said material is nylon.

20 20. A multicolor flock transfer comprising:

a) a base sheet having a surface area coated with a release adhesive;

b) precolored flock of at least two different colors having ends adhering to said surface area to form
25 predetermined color patterns of a design; and

c) a binding adhesive applied to other ends of said precolored flock.

21. The multicolor flock transfer of claim 20, wherein said precolored flock comprises fibers having a length
30 greater than 0.3 mm.

22. The multicolor flock transfer of claim 21, wherein said length is within the range of 0.5 mm to 3 mm.

23. The multicolor flock transfer of claim 21, wherein said length is within the range of 3 mm to 5 mm

35 24. The multicolor flock transfer of claim 23, wherein said length within the range of 5 mm to 1 cm.

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25. The multicolor flock transfer of claim 21, wherein said length is longer than 1 cm.

26. The multicolor flock transfer of claim 21, wherein said flock comprise conductive material.

5 27. The multicolor flock transfer of claim 26, wherein said conductive material is a synthetic material.

28. The multicolor flock transfer of claim 27, wherein said synthetic material is selected from the group consisting of acrylic, rayon, nylon, polyester and
10 polyamide.

29. The multicolor flock transfer of claim 28, wherein said flock comprise rayon.

30. The multicolor flock transfer of claim 26, wherein said base sheet is selected from the group consisting of
15 paper, resin and metal foil.

31. The multicolor flock transfer of claim 30, wherein said sheet is paper.

32. The multicolor flock transfer of claim 30, wherein said release adhesive is selected from member of the group
20 consisting of silicone wax, polyvinyl acetate, polyvinyl alcohol, polyvinyl chloride, polyvinyl butyral, acrylic resin, polyurethane, polyester, polyamides, cellulose derivatives, rubber derivatives, starch, casein, dextrin, gum arabic, carboxymethyl cellulose, resin and mixtures of
25 at least two of said members.

33. The multicolor flock transfer of claim 32, wherein said release adhesive is silicone wax.

34. The multicolor flock transfer of claim 32, wherein said binding additive comprises a resin.

30 35. The multicolor flock transfer of claim 34, wherein said resin is selected from the group consisting of polyvinyl chloride, polyvinyl acetate, polyurethane, polyester, polyamide, and acrylic resin.

36. The multicolor flock transfer of claim 35, wherein
35 said resin is an acrylic resin.

37. The multicolor flock transfer of claim 36, wherein

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said acrylic resin is a water-based acrylic.

38. The multicolor flock transfer of claim 34, wherein said binder adhesive comprises a supplemental adhesive selected from the group consisting of hot melt adhesives.

5 39. The multicolor flock transfer of claim 38, wherein said hot melt adhesive is selected from the group consisting of polyurethane, polyester and nylon.

40. The multicolor flock transfer of claim 20, further comprising:

10 d) a layer of supplemental adhesive covering said binding adhesive.

41. The multicolor flock transfer of claim 40, wherein said supplemental adhesive is selected from the group consisting of polyurethane, polyester, nylon, polyamide, 15 polyethylene, thermoplastic acrylic resin, polyvinyl chloride, paraffin and rubber derivatives.

42. The multicolor flock transfer of claim 41, wherein said supplemental adhesive is selected from the group consisting of polyurethane, polyester and nylon.

20 43. A process for manufacturing transfer sheets comprising:

forming on the surface of a base sheet an adhesive layer for temporary adhesion of a plurality of different colored flock fibers to the base sheet, temporarily sticking 25 said different colored flock to said adhesive layer to form a multicolored fiber layer, and applying an adhesive in said multicolor fiber layer to a desired pattern to form a binding adhesive layer, wherein said colored flock are precolored to said plurality of different colors before 30 sticking said different colored flock fibers to said adhesive layer.

44. The process for manufacturing multicolor transfer sheet in accordance with claim 43, wherein said colored flock comprises fibers having a length within the range of 3 35 mm to 5 mm.

45. The multicolor flock transfer of claim 44, wherein

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said length is within the range of 5 mm to 1 cm.

46. A multicolored flock transfer comprising precolored flock including fibers having a length longer than about 3 mm.

5 47. The multicolor flock transfer wherein said length is within the range of about 3 mm to 5 mm.

48. The multicolor flock transfer of claim 46, wherein said length is within the range of 5 mm to 1 cm.

49. The multicolor flock transfer of claim 46 wherein
10 said length is longer than 1 cm.

50. A fabric comprising:

a) a substrate material;

b) a layer of binding adhesive having a predetermined design applied to said substrate; and

15 c) precolored flock of at least two different colors adhering to said layer.

51. The fabric of claim 50, wherein said flock comprises fibers having a length longer than about 3 mm.

52. The fabric of claim 51, wherein said length is
20 within the range of about 3 mm to about 5 mm.

53. The fabric of claim 51 wherein said length is within the range of about 5 mm to about 1 cm.

54. The fabric of claim 51 wherein said length is longer than about 1 cm.

25 55. A method of applying a flocked design onto a product comprising:

a) printing a release adhesive on a plurality of base sheets;

b) flocking with different precolored flocks into
30 said adhesive to form a plurality of color patterns into said predetermined design in said adhesive;

c) applying a binding adhesive to free ends of said precolored flocks to form flock transfer sheets; and

d) transferring said precolored flock from one of
35 said flock transfer sheets onto a substrate material to vividly form said flock in said predetermined design on said

substrate material thereby¹⁷ producing a product having a flocked design.

56. The method of claim 55, wherein said flocks comprise fibers having a length longer than 3 mm.

5 57. The method of claim 56, wherein said length is within the range of about 3 mm - 5 mm.

58. The method of claim 56, wherein said length is within the range of 5 mm - 1 cm.

59. The method of claim 56, wherein said length is
10 longer than 1 cm.

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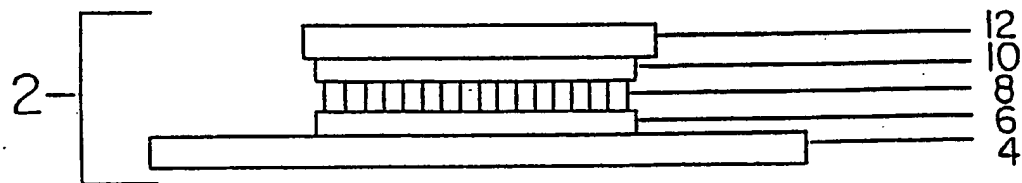


FIG. 1

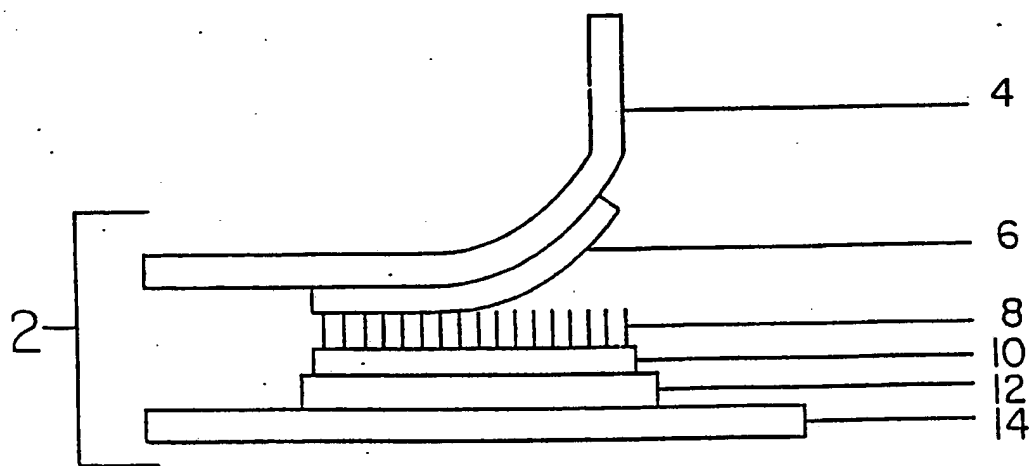
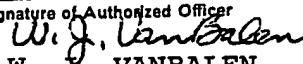


FIG. 2

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US88/02828

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC INT. CL. B05D 1/16; B32B 3/02, 33/00 US. CL. 156/72; 427/206; 428/88, 90		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
US	156/72 428/88, 90 427/206	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
Y	US, A, 3,793,050 (MUMPOWER) 19 FEBRUARY 1974. SEE ENTIRE COLUMNS 3 AND 4.	1-59
Y	US, A, 4,142,929 (OTOMINE) 06 MARCH 1979. ENTIRE COLUMNS 1 AND 2.	1-59
Y	US, A, 4,396,662 (HIGASHIGUCHI) 02 AUGUST 1983 ENTIRE COLUMNS 5 AND 6.	1-59
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
11 OCTOBER 1988		01 DEC 1988
International Searching Authority		Signature of Authorized Officer
ISA/US		 W. J. VANBALEN